Behavior of spatially homogeneous and inhomogeneous random networks

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Networks of simple structural elements such as axial force and beam elements are generated and their response to imposed deformations is calculated numerically. Three types of networks are studied: geometrically regular networks such as triangular and hexagonal networks, random networks which are statistically homogeneous spatially, and random networks which are spatially inhomogeneous. Both types of random networks are generated using the Voronoi tessellation and its dual, the Delaunay triangulation. The Voronoi tessellation and Delaunay triangulation are known to provide reasonable approximations to the microstructure of a broad class of crystalline and cellular materials.

The statistics of a variety of response parameters of the networks are estimated using Monte Carlo simulation. Response parameters considered include the effective material properties, localization of stress and strain, sites of probably damage initiation, and the ultimate strength of the networks. Some preliminary work is presented which seeks to determine the relationship between the behavior of the random networks and random crystalline and/or cellular solids.